蝶と蛾 *Trans. lepid. Soc. Japan* **53** (1): 63-68, January 2002

Internal conditions of bagworms of five large species of the Psychidae (Lepidoptera)

Misako WAKAZONO[1)] and Shintaro FUNAKOSHI[2)]

[1)]Department of Life Science, Faculty of Science, Himeji Institute of Technology
Shosha, Himeji, Hyogo Prefecture, 671-2201 Japan
[2)]Ohgakikita High School, Nakagawa-cho 4-110-1, Ohgaki, Gifu Prefecture, 503-0017 Japan

Abstract Most of the bagworms of *Eumeta japonica* (Heylaerts) contained pupal cases of parasite flies. The number of parasite fly's pupae varied, ranging from 1 to 42 per bagworm. Living larvae of *E. japonica* were noted as being fewer than those of other species.

Key words Bagworm moth, parasite, decrease of bagworms, *Eumeta japonica* (Heylaerts).

Introduction

Large bagworm moths have already been identified as both polyphagous species and important pests of shading and ornamental trees and shrubs in streets, parks and gardens (Okuno *et al*., 1977; Oho, 1980; Inoue *et al*., 1982). The parasites of large bagworm moths have been well documented up to now (Iwata, 1950; Hirose & Kato, 1964; Berisford and Tsao, 1975; Momoi, 1977). In recent years, a decrease in the number of *Eumeta japonica* (Heylaerts) has been reported by Yamamoto *et al*. (1998). They showed that this decrease in bagworms was caused by the appearance of the parasite fly, *Nealsomyia rufella*, whose number has been increasing with time (Kanazawa *et al*., 1999).

We investigated the internal conditions and the ratio of parasites of five large bagworm moths: *Eumeta japonica* (Heylaerts), *E. minuscula* Butler, *Bambalina* sp., *Acanthopsyche nigraplaga* (Wileman), *Mahasena aurea* (Butler), in Gifu Prefecture, central Japan.

Materials and methods

Bagworms left on twigs, sprays and leaves, were searched during winter in the years 2000 and 2001 at the investigating sites located in places such as parks, gardens, banks, mountain passes, camps, orchards, approaches to shrine buildings, and their surrounding area, in Gifu Prefecture. Searches in high trees were carried out by using binoculars. Bagworms were collected from *Prunus* spp., *Punica granatum* L., *Viburnum awabuki* K. Koch, *Cornus florida* L., *Diospyros kaki* Thunb., *Castanea crenata* Sieb. et Zucc., *Acer* sp., *Lagerstroemia indica* L., *Rhododendron* sp., *Zelkova serrata* Makino and other trees at the investigation sites. The number of trees investigated in the parks and the other sites was recorded and the number of bagworms attached to the trees was calculated. All of the 1,256 bagworms were collected by hand or by using a pruning hook during the winter periods over two years. All bagworms were identified, measured for length and dissected with anatomical scissors to confirm the presence of larvae and parasitism, in a laboratory.

We divided the five species of bagworms each into seven groups based on their internal conditions, *i. e.* empty, dead as a result of factors other than parasites, parasitized by wasps, parasitized by flies, ♀ pupal skin cast, ♂ pupal skin cast, and the presence of bagworm

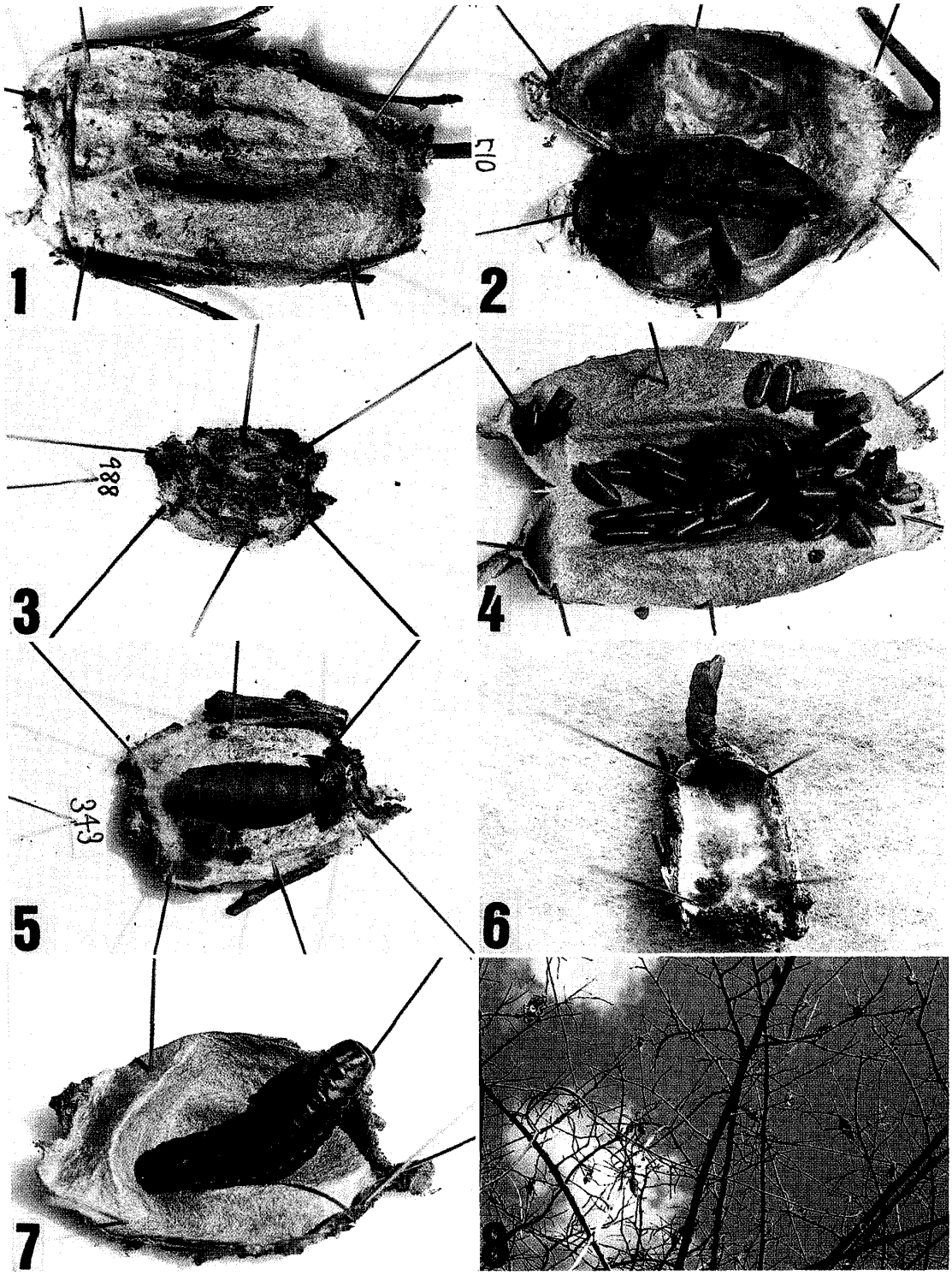

Fig. 1. Empty bagworm of *Eumeta japonica* (Heylaerts).
Fig. 2. Dead as a result of factors other than parasites in *Eumeta japonica* (Heylaerts).
Fig. 3. *Bambalina* sp. parasitized by wasp.
Fig. 4. *Eumeta japonica* (Heylaerts) parasitized by fly.
Fig. 5. ♀ pupal skin cast of *Eumeta minuscula* Butler.
Fig. 6. ♂ pupal skin cast of *Eumeta minuscula* Butler.
Fig. 7. Presence of bagworm moth' larva of *Eumeta japonica* (Heylaerts).
Fig. 8. 119 bagworms of *Eumeta japonica* (Heylaerts) were found on a tree of *Lagerstroemia indica.*

Table 1. The number of trees and large bagworms of five species at investigation sites.

Area	Species of trees	Total of trees	Total of bags	*E. japonica*	*E. minuscula*	*B.* sp	*A. nigraplaga*	*M. aurea*
garden	*Prunus* spp. *Viburnum awabuki* K. Koch	124	48	1	47	0	0	0
bank	*Prunus* spp.	125	34	3	31	0	0	0
pass	*Prunus* spp.	102	12	7	3	0	0	2
garden	*Punica granatum* L.	6	32	5	24	0	3	0
park	*Cornus florida* L.	72	124	0	70	54	0	0
camp	*Prunus* spp.	74	4	2	0	0	1	1
park	*Prunus* spp.	40	18	5	13	0	0	0
park	*Prunus* spp.	114	0	0	0	0	0	0
bank	*Prunus* spp.	142	43	2	37	1	3	0
precincts	*Prunus* spp.	27	0	0	0	0	0	0
orchard	*Diospyros kaki* Thunb. *Castanea crenata* Sieb. et Zucc.	104	36	10	20	3	3	0
park	*Acer* sp *Lagerstroemia indica* L.	38	207	203	4	0	0	0
approach	*Prunus* spp., *Acer* sp.	137	13	13	0	0	0	0
park	*Prunus* spp., *Acer* sp.	163	49	23	6	19	1	0
garden	*Prunus* spp., *Viburnum awabuki* K. Koch *Rhododendron* sp. *Zelkova serrata* Makino	174	252	4	247	1	0	0
	Total	1,442	872	278	502	78	11	3

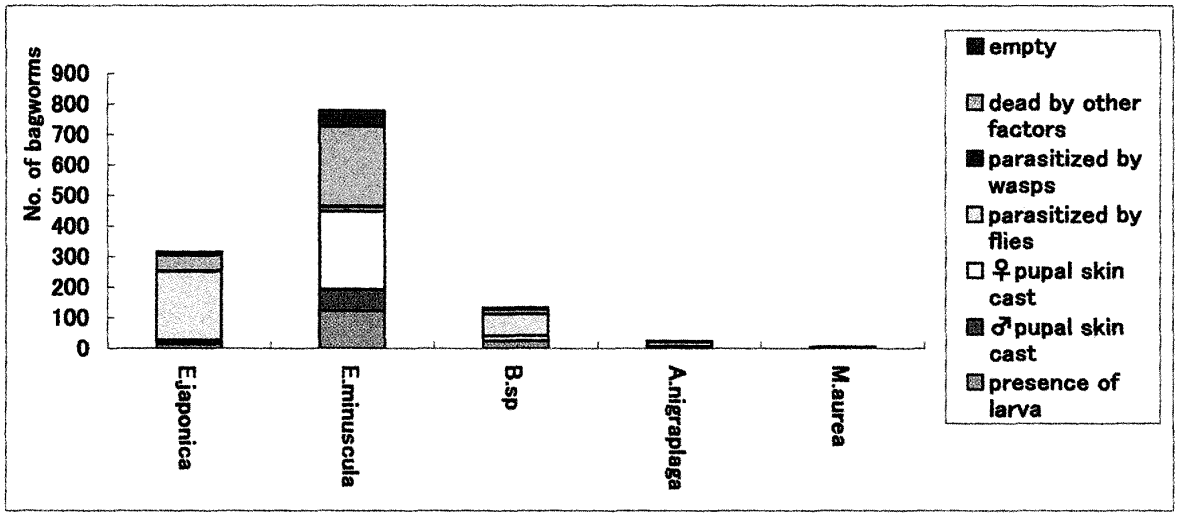

Fig. 9. The ratio of internal conditions of five bagwarm moths.

moths' larvae (Figs 1-7).

Results

Table 1 shows the number of trees and large bagworms of the five species collected at investigation sites such as gardens, parks and so on. Only one bagworm per two trees was estimated as an average at investigation sites. But, in reality, they tend to group together in large numbers on just a few trees, and not at all on others. For example, 119 bagworms of *E. japonica* were found on a tree of *Lagerstroemia indica* (Fig. 8). On the other hand, no bagworms were found on the 114 trees in the park in Gifu city. Fig. 9 shows the ratio of

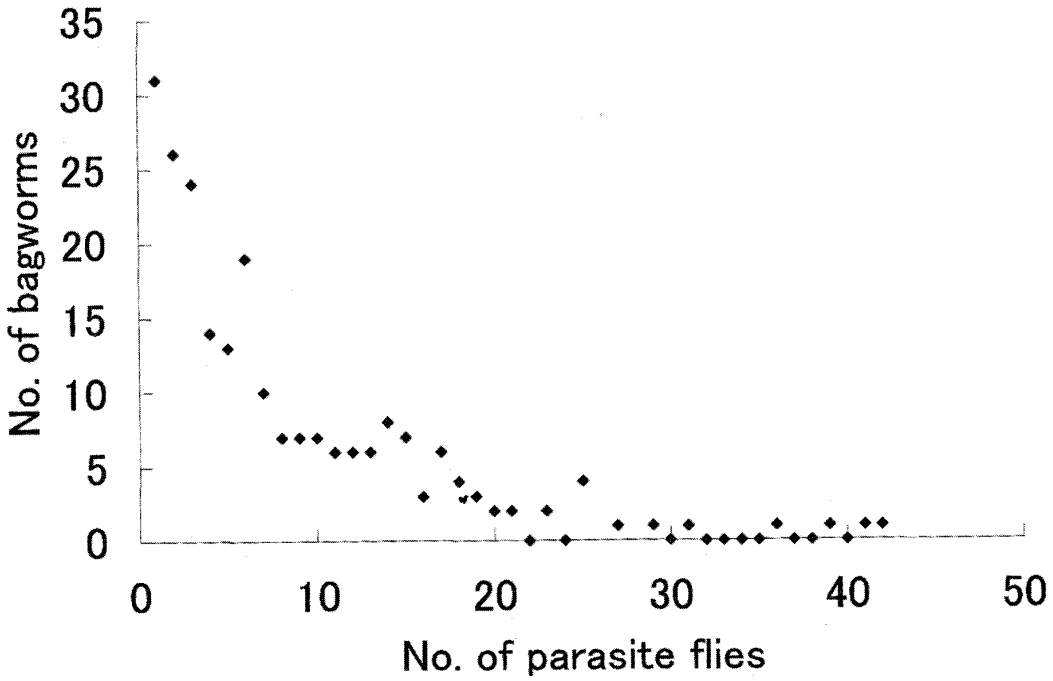

Fig. 10. Number of parasitic flies per bagworm of *Eumeta japonica* (Heylaerts).

internal conditions of five bagworm moths. Up to now, 315 bags of *E. japonica* were gathered and dissected. Among them, 71.1% of the bagworms were parasitized by parasitic flies such as *Nealsomyia rufella*. Living larvae numbered only 4.4%, and pupal skin cast 4.1%. In contrast, in the case of *E. minuscula*, 2.2% bagworms were parasitized, living larvae numbered 15.7%, pupal skin casts numbered 41.9%, based on 778 collected bagworms. Furthermore, in the case of *Bambalina* sp. 51.9% bagworms were parasitized, living larvae numbered 18.0%, pupal skin casts numbered 11.3%, based on 133 collected bagworms. Finally, in the case of *Acanthopsyche nigraplaga* 4.2% bagworms were parasitized, living larvae numbered 25.0%, pupal skin casts numbered 62.5%, based on 24 collected bagworms. Only 6 bagworms of *Mahasena aurea* were collected during the investigating period. Fig. 10 shows the number of parasitic flies per bagworm of *E. japonica*. Some bagworms had pupae of a few species of parasitic flies and the others had many pupae of just one fly. The largest number recorded was 42 fly pupae in one bagworm.

Discussion

43,000 bagworms of *E. japonica* and *E. minuscula* were investigated during just two years in the Kinki district (Nishida, 1983). But large bagworm moths were either scarcely attached, or not attached at all, to almost all trees at investigating sites during winter over the two years in the Tokai district. Therefore it was not possible to collect many samples, unlike former times, in the Kinki district. It was thought that the number of large bagworm moths has been decreasing rapidly in recent years in the Tokai district. It has been suggested that the reason is the increase in the ratio of parasites to bagworm moths. Male pupae were parasited at a much higher rate than female pupae (Nishida, 1983). Pupal skin casts in female bagworms were more numerous than those in males in this investigation. Particularly, female pupae numbered 14.5 times more than male in *E. minuscula*. It was again shown that the number of parasites on males was higher than on females. Almost all *E. japonica* were

parasitized by parasitic flies in the Tokai district, as in the Kinki district. In the near future, it is thought that there will be an extreme decrease in bagworms of *E. japonica* in this area, too. One or two parasitic fly pupae were found in the bagworms of *Bambalina* sp., which have slender and small bagworms (length 2.93±0.61 cm, $n=133$), and a few pupae in one of *E. minuscula* which also have small bagworms (length 2.66±0.59 cm, $n=778$). On the other hand, various numbers (from one to forty-two) of parasitic fly pupae were recognized in the bagworms of *E. japonica* which have large bagworms (length 4.59±0.65 cm, $n=315$). It is true to say that large larvae of bagworm moth have a capacity to rear many parasitic fly larvae. In most cases only one or two pupae of parasitic flies were found in a bagworm, but occasionally a large number of pupae were found. It was concluded that in such cases several different parasitic flies had laid eggs on one single bagworm.

Acknowledgements

We are grateful to Prof. H. Shima, Kyushu University, for his invaluable comments and encouragements. We wish to express our hearty thanks to Dr Itaru Kanazawa, Osaka City Museum, and Mr Akio Seino, Niigata Prefecture, for sending much literature and advice. Our thanks are also due to Messrs Harumi Sugiyama, Syuhei Tuchikawa, Tomoko Kondou, Ohogakikita High School, Gifu Prefecture for collecting samples. We gratefully thank Mr Andy del Strother, Ohgakikita High School, for correcting the English.

References

Berisford, Y. C., & C. H. Tsao, 1975. Parasitism, predation and disease in the bagworm, *Thyridopteryx ephemeraeformis* (Haworth) (Lepidoptera; Psychidae). *Envir. Ent.* **4**: 549–554.

Hirose, Y. & T. Kato, 1964. Pupal parasites of *Clania variegata* Snellen (Lepidoptera: Psychidae) in Fukuoka. *Proc. Ass. Pl. Prot. Kyushu* **10**: 57–60 (in Japanese).

Inoue, H. 1982. Psychidae. *In* Inoue, H., Sugi, S., Kuroko, H., Moriuti, S. & A. Kawabe, *Moths of Japan* **1**: 158–162; **2**: 184–185, pls 4, 296. Kodansha, Tokyo. (In Japanese).

Iwata, K. 1950. Biology of *Ichneumon* parasites on bagworms in Japan, I. *Trans. Kansai ent. Soc.* **15**: 35–47.

Kanazawa, E., Yamamoto, H. & K. Nakatani, 1999. Bagworm moths at city of Kansai area. *Nature Study* **45** (9): 2–4 (in Japanese).

Momoi, S., 1977. Hymenopterous parasites of common large bagworms occurring in Japan, with descriptions of new species of *Scambus* and *Sericopimpla*. *Akitu* (N. S.) **14**: 1–12.

Nishida, E., 1983. Biologies and parasite complexes of two bagworms, *Eumeta japonica* and *Eumeta minuscula* (Lepidoptera, Psychidae). *Kontyû* **51**: 394–411.

Oho, N. *et al*., 1980. *Major Insect and other Pests of economic Plants in Japan*. 307 pp. Japan Plant Protection Association, Tokyo. (In Japanese).

Okuno, T., Tanaka, Y. & Y. Kimura, 1977. *Diseases and Pests of cultivated Trees and Shrubs in Colour*. 365 pp. Hoikusha, Osaka. (In Japanese).

Yamamoto, H., Kanazawa, E. & K. Nakatani, 1998. Disappearance of *Clania variegata* Snellen. *Nature Study* **44** (2): 3–6 (in Japanese).

摘　　要

ミノガ大型5種のミノ内部の解析 (若園美沙子・船越進太郎)

近年，オオミノガヤドリバエの出現とそれに続く寄生率の増加により，オオミノガ *Eumeta japonica* (Heylaerts) が激減しているという (金沢・山本・中谷，1999). 岐阜県における現状を調べるために，オオミノガとその他の大型種，すなわちチャミノガ *E. minuscula* Butler，ネグロミノガ *Acanthopsy-*

che nigraplaga (Wileman), ニトベミノガ *Mahasena aurea* (Butler), クロツヤミノガ *Bambalina* sp. について調べた．調査は2000年および2001年の冬季より早春の落葉樹の葉が失われている期間であり，採集した1,256のミノはすべて内部を開き，7つの項目に分類した．すなわち，空の状態，死亡個体や崩壊殻片などが存在し，寄生以外の他の要因によって死んだもの，寄生バエの囲蛹殻の存在したもの，寄生バチの蛹殻の存在したもの，雌の羽化殻，雄の羽化殻，生存幼虫がいたものである．その結果，チャミノガ，ネグロミノガ，クロツヤミノガはたくさんのミノが見つかり，生存個体も多かったのに対し，オオミノガ，ニトベミノガのミノは少なく，それらのミノの中にもほとんど生存個体を見出すことができなかった．また，オオミノガ1個体あたりの寄生バエの囲蛹の存在数は1から42の範囲で見られた．チャミノガやクロツヤミノガは1もしくは2のものがほとんどであった．オオミノガの幼虫の大きさからたくさんの寄生生物の幼虫を養えると考えられるが，大部分のものは少ない囲蛹数であったことから，多くの寄生バエ囲蛹の存在は寄生バエ雌成虫の複数回産卵の結果ではないかと考えられた．

(Accepted June 5, 2001)

Published by the Lepidopterological Society of Japan,
5-20, Motoyokoyama 2, Hachioji, Tokyo, 192-0063 Japan